Applicants' invention is directed to a wafer polishing head including a carrier, retaining ring, a first pressure chamber, a second pressure chamber and an automatic control system. By coupling to the first pressure chamber and the second pressure chamber, the automatic control system controls and regulates different pressure inputs to the pressure chambers according to the feedback pressure signals acquired when chemical mechanical polishing (CMP) is performed. Consequently, the relative height between the carrier and the retaining ring is controlled by the relationship between the pressures respectively applied to the first pressure chamber and the second pressure chamber. And the polishing head of the invention can greatly improve a polishing uniformity.

Nakashiba et al. disclose an apparatus for and method for polishing work piece. The apparatus includes a top ring 1 for providing a pressing force F1 and a presser ring 3 disposed around the top ring 1 for providing a pressing force F2. The pressing force F1 is adjusted from an air pressure supplied to a top ring air cylinder 10 connected with a part of the top ring 1, while the pressing force F2 is adjusted from an air pressure supplied to the presser ring air cylinder 22 connected with a part of the presser ring 3. By adjusting the pressing force F2 with respect to the pressing force F1, the distribution of polishing pressures is made continuous and uniform from the center of the semiconductor wafer 4 to its peripheral edge and further to the outer circumferential edge of the presser ring 3.

As stated in the office action, the top ring air cylinder 10 and the presser ring air cylinder 22 have been cited to teach the first pressure chamber and the second pressure chamber in Applicants' invention. However, the top ring air cylinder 10 and the presser ring air cylinder 22 are regulated respectively by regulators R4 and R5. Nakashiba et al. do not disclose any control system for receiving feedback pressure values and processing the feedback pressure values so as to control the pressures in the air cylinders. Accordingly, Applicants respectfully submit that

Nakashiba et al. fail to disclose an automatic control system coupled to the first and second pressure chambers for receiving, processing, and transmitting the feedback signals of the first and second pressure chambers during the CMP process.

As recited in Claim 1 of the present application, the automatic control system receives a first feedback pressure signal transmitted from the first pressure chamber and a second feedback pressure signal transmitted from the second pressure chamber. The automatic control system also transmits respectively a first pressure value and a second pressure value to the first pressure chamber and the second pressure chamber.

Similarly, Claim 7 has been amended to recite the automatic control system for processing the first and second inner pressures as feedback digital signals, comparing the feedback digital signals, and producing digital signals from the feedback digital signals to control a relative height between the carrier and the retaining ring through the first and second pressure chambers. It is clearly evident in Applicants' invention that during the CMP process different pressures in the first and second pressure chambers are adjusted by the automatic control system as recited above which process the pressure values into the digital signals. The digital signals are then compared and output to control and regulate the pressure values in the first and second pressure chambers by the regulators. So, the dynamic response of the relative height between the carrier and the retaining ring can be easily controlled by changing the pressure of the fluid flowing into the first chamber pressure and the second pressure chamber. As a result, the bottom of the retaining ring is frequently maintained lower than that of the carrier, thereby preventing the semiconductor wafer from slipping during the CMP process. The semiconductor can be well protected during polishing and the lifetime of the retaining ring is extended.

Accordingly, Nakashiba et al. are not believed in any way to anticipate the specific features recited in Claims 1 and 7. Therefore, Claims 1 and 7 are believed to be allowable.

Substantially the same arguments as set forth above with regard to Claims 1 and 7 also apply to dependent Claims 4-6, which depend directly from Claim 1, respectively, and dependent Claim 11, which depends directly from Claim 7. Accordingly, each of the dependent claims is also believed to be allowable.

Consequently, in view of the present amendment, it is respectfully submitted that this application is in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Gregory J. Maier
Registration No. 25,599
Robert T. Pous
Registration No. 29,099
Attorneys of Record

22850
Tel: (703) 413-3000
Fax: (703)413-2220
GJM/RTP/MSM:ys
I:\user\MSMOR\200690US2CONT.FinalAme.wpd

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IN THE SPECIFICATION

Page 1, before line 5, please insert:

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation of patent application Serial No. 09/482,936, filed January 14, 2000, which is a Continuation-in-Part Application of U.S. Application Serial No. 09/185, 098, filed November 3, 1998.

IN THE CLAIMS

Please amend Claim 7 as follows:

--7. (Amended) A wafer polishing head for planarizing a wafer, comprising:

a carrier for loading the wafer;

a retaining ring surrounding the carrier;

a first pressure chamber having a first inner pressure disposed above the retaining ring;

a second pressure chamber having a second inner pressure disposed on the carrier; and

an automatic control system respectively coupled to the first pressure chamber and the second pressure chamber for processing the first and second inner pressures as feedback digital signals, comparing the feedback digital signals, and producing digital signals from the feedback digital signals to control a relative height between the carrier and the retaining ring through the first and second pressure chambers.--